REMARKS

The Examiner has noted that Fig. 1 should be labeled as Prior Art. Applicants submit herewith a Replacement Sheet with the notation PRIOR ART added.

The Examiner has objected to Claims 1, 2, 4, 6, 9, 11, 12, 14, 15 and 17 due to informalities with respect to the use of the "*" and the multiplication symbol "•". By the present amendments, Applicants address the Examiner's concern.

The Examiner has objected to Claim 12 as being of improper dependent form for failing to further limit the subject matter of the previous claim. Applicants believe that Claim 12 does limit Claim 9, since Claim 12 recites not only that the IDFT means generates the complex symbols z(n), but that it generates complex symbols z(n) which comprise x(n)+j•y(n), where x(n) and y(n) are real sequences (see: page 13, lines 17-21).

The Examiner has rejected Claim 8 under 35 USC 101 as non-statutory. Applicants have amended Claim 8 to expressly recite a computer readable storage medium storing the program code for performing the method.

The Examiner has rejected Claims 2 and 11 under 35 USC 112, second paragraph, as being indefinite. Applicants

respectfully traverse the rejection. Claims 1 and 9 recite steps and means for modulating sub-carrier symbols F(k) to a signal f(n) including generating complex output symbols z(n) in advance of multiplexing the complex output symbols into even and odd samples of the signal f(n). The dependent claims, Claims 2 and 11, generate complex output symbols x(n)+j•y(n), where x(n) and y(n) are real sequences. The dependent claims detail the additional steps and means for applying the steps and means of the independent claims, Claims 1 and 9, to a particular spectrum F(i) of the intermediate frequency OFDM signal f(n). Applicants respectfully assert that the dependent claims clearly recite additional functional steps beyond those cited in the independent claims. Applicants further assert that the claims are clear as to how the functions, symbols and sequences relate. As expressly recited in Claim 2, sub-carrier symbols F(k) are assigned to a spectrum F(i) of intermediate frequency OFDM signal f(n). The claim additionally states that Z(k)=X(k)+j•Y(k), where X(k) and Y(k) define the spectra of real sequences x(n) and y(n). The IDFT is then performed on Z(k) to generate the complex output symbols x(n)+j•y(n), which are then transformed to the intermediate-frequency OFDM signal (f(n)), by multiplexing the real and imaginary parts of the

complex output symbols z(n), which is x(n)+j•y(n), into even and odd samples of the intermediate frequency OFDM signal (f(i)). Applicants respectfully request reconsideration of the rejection of Claims 1 and 11 as indefinite.

The Examiner has rejected Claims 1-18 under 35 USC 103(a) as unpatentable over Fertner. For the reasons set forth below, Applicants believe that the claims are patentable over the cited art.

The present invention is directed to a method and apparatuses for modulating and demodulating sub-carrier symbols onto signals. Under the present invention, the pre-processing of the sub-carrier symbols is performed so that complex output symbols are generated by an IDFT but wherein the real ***and*** imaginary parts of the complex output symbols are multiplexed to real samples of the intermediate frequency OFDM signal (see: page 4, lines 13-18). As taught from page 11, line 30-page 12, line 7, the pre-processing makes it possible to remove the digital I/O modulation and use the IDFT unit with the pre-preprocessing unit and the parallel-to-serial unit to directly generate the IF signal as a real valued intermediate frequency ODFM signal. The present invention serializes the complex IDFT output symbols and multiplexes both the real and imaginary

parts of the symbols into even and odd samples of the signal.

The Fertner patent is directed to computing a discrete Fourier transform (DFT) and an inverse discrete Fourier transform (IDFT), but does not teach or suggest multiplexing real and imaginary parts of complex output symbols into even and odd samples of an intermediate frequency OFDM signal. Fertner expressly teaches, at Col. 5, lines 9-11, that "computing the FDT of a real-valued sequence that is twice as long as the DFT input with one half of a real-valued sequence [being] treated as the real part and the other half of the real-valued sequence [being] treated as the imaginary part". Fertner is able to "rearrange the data so that even samples form the real portion of the complex number...and the odd samples form the imaginary part of the created complex-valued sequence" (Col. 5, lines 23-26). Fertner not only does not attempt to multiplex real and imaginary parts of complex output symbols into a signal, but expressly teaches treating half of a real-valued sequence as imaginary in order to reduce computations.

Applicants respectfully assert that the cited Fertner equations, for example Equations 9, 10, 11 and 13, do not teach or suggest the Z(k) function taught and claimed by

the present invention. Applicants request clarification of the rejections, since it is clear that the Fertner equations are not the same as or suggestive of the presently claimed function. Applicants additionally request clarification of the Examiner's statement that "Col. 8, lines 18-26 indicate the preparation block 46 performs the same function of the Extraction Block 42 of Fig. 4". The present claims do not recite a preparation block or an extraction block. Moreover, the cited teachings regarding the functions of the Fertner blocks do not obviate the invention as claimed. As described by Fertner in Col. 7, lines 49-56, the extraction block selects alternate samples so that "the data rate of the corresponding complex sequence...is half the data rate of the input sequence." Selecting alternate samples is not the same as or suggestive of transforming sub-carrier symbols F(k) to pre-processed sub-carrier symbols Z(k) according to the claimed function:

$$Z(k) = \frac{1}{2} \cdot \left[F(k) + F(N-k)^* \right] + \frac{1}{2} \cdot j \cdot \left[F(k) - F(N-k)^* \right] \cdot e^{+j\pi k/N} .$$

While Fertner does perform an IDFT, Applicants respectfully assert that Fertner does not teach or suggest performing a complex IDFT on the pre-processed sub-carrier symbols Z(k), since Fertner neither teaches nor suggests the pre-processing to Z(k) using the foregoing formula. The cited passage from Col. 4, lines 44-64 of Fertner observes that the DFT and IDFT operations can be performed by the same computing device, but does not teach or suggest the claim language. Similarly, the passage from Col. 7, lines 24-39 refers to selective sampling while preserving Hermite symmetry to allow one computing device to perform multiple computations but does not teach or suggest the steps and means for computation as set forth in the pending claims.

With regard to the claim features of steps and means for transforming the complex output symbols z(n) to the intermediate-frequency OFDM signal (f(n)), by multiplexing the real and imaginary parts of the complex output symbols z(n) into even and odd samples of the intermediate frequency OFDM signal (f(n)), Applicants assert that the Fertner patent teaching do not obviate the invention as claimed. The Examiner cites passages from Col. 7, lines 39-47 which expressly states that "because the real and imaginary portions of each complex point correspond to real

information, the N-point complex sequence is effectively expanded into a 2N-point real sequence, i.e., $x_1(n)+jx_2(n)$". Fertner is teaching selective sampling for "effectively expanding", which is not the same as of suggestive of the claimed transforming and multiplexing. The passage from Col. 8, lines 43-49 describes expander block 52 which generates real numbers from the real and imaginary portions of each complex number. The cited passage does not teach or suggest the claim features against which it is cited.

For a determination of obviousness, the prior art must teach or suggest all of the claim limitations. "All words in a claim must be considered in judging the patentability of that claim against the prior art" (*In re Wilson*, 424 F. 2d 1382, 1385, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970). Since Fertner fails to teach or suggest each and every one of the claim limitations of the independent claims, a *prima facie* case of obviousness has not been established by the Examiner against independent claims 1, 4, 7, 8, 9, or 14 or against the remaining claims that depend therefrom and add further limitations thereto.

Based on the foregoing amendments and remarks, Applicants respectfully request entry of the amendment, reconsideration of the rejections, and issuance of the claims.

Respectfully submitted,

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